UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,432	03/31/2004	Peter Feldmann	YOR920040053US1	7656

29683	7590	10/18/2006		EXAMINER

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	SHARON, AYAL I

ART UNIT	PAPER NUMBER
2123	

DATE MAILED: 10/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/815,432	FELDMANN ET AL.
	Examiner	Art Unit	
	Ayal I. Sharon	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>31 March 2004</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-24</u> is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-24</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>31 March 2004</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some *   c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____.

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date <u>3/31/2004</u>.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Introduction

1. Claims 1-24 of U.S. Application 10/815,432 filed on 3/31/2004 are currently

pending.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3. **Claims 1-24 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.**

4. The claims in the instant application are directed to an abstract idea. One may not patent every "substantial practical application" of an idea, law of nature or natural phenomena because such a patent "in practical effect be a patent on the [idea, law of nature or natural phenomena] itself." Gottschalk v. Benson, 409 U.S. 63, 71-72, 175 USPQ 673, 676 (1972).

5. The instant claims also lack a concrete, useful, and tangible result.

6. The fundamental test for patent eligibility is to determine whether the claimed invention produces a **"useful, concrete and tangible result."** See State Street Bank & Trust Co. v. Signature Financial Group Inc., 149 F. 3d 1368, 47 USPQ2d 1596 (Fed. Cir. 1998) and AT&T Corp. v. Excel Communications, Inc., 172 F.3d

1352, 50 USPQ2d 1447 (Fed. Cir. 1999). In these decisions, the court found that

the claimed invention as a whole must accomplish a practical application. That is,

it must produce a "useful, concrete and tangible <u>result</u>."

7. See <u>State Street</u>, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02. ("[T]he

transformation of data, representing discrete dollar amounts, by a machine

through a series of mathematical calculations into a final share price, constitutes

a practical application of a mathematical algorithm, formula, or calculation,

because it produces 'a useful, concrete and tangible result' – a final share price

momentarily fixed for recording and reporting purposes and even accepted and

relied upon by regulatory authorities and in subsequent trades").

8. See also <u>AT&T</u>, 172 F.3d at 1358, 50 USPQ2d at 1452 (Claims drawn to a long-

distance telephone billing process containing mathematical algorithms were held

patentable subject matter because the process used the algorithm to produce a

useful, concrete, tangible result - a primary inter-exchange carrier ("PIC")

indicator - without preempting other uses of the mathematical principle).

9. The Examiner respectfully submits that under current PTO practice, the claimed

invention does not recite a concrete, useful, tangible result.

10. In addition, claims 9-16 are directed to a "signal bearing medium tangibly

embodying a program". This category, when broadly interpreted, includes signal

bearing media such as carrier waves. According to the <u>Interim Guidelines for</u>

<u>Examination of Patent Applications for Patent Subject Matter Eligibility</u> (OG

Notices: 11 July 2006) signal claims are ineligible for patent protection because

they do not fall within any of the four statutory classes of § 101. (See especially

pp.55-57. Available at:

http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/guidelines101_2005

1026.pdf). Claims 9-16 are therefore also rejected on these grounds.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. The prior art used for these rejections is as follows:

    a. U.S. Patent 5,604,911 to Ushiro. ("**Ushiro**").

13. The claim rejections are hereby summarized for Applicant's convenience. The

detailed rejections follow.

14. Claims 1-24 are rejected under 35 U.S.C. 102(b) as being anticipated by

Ushiro.

15. In regards to Claim 1, Ushiro teaches the following limitations:

> *1. A method to determine a numerical solution of a linear system of equations representing a physical entity, comprising:*

(See Ushiro, especially: col.2, lines 40-62)

> *generating a mesh representation of the physical entity, the mesh representation comprising mesh elements;*

(See Ushiro, especially: Fig.5 and col.8, lines 45-50; and Fig.4, steps 13-14; and col.8, lines 32-45)

*computing a linear system matrix A of coefficients by computing
interactions between simple functions defined over sets of mesh elements;*

(See Ushiro, especially: Fig.4, steps 14-17; and col.8, lines 32-45)

*partitioning the mesh representation into a plurality of partitions separated
by partition boundaries; and*

(See Ushiro, especially: Fig.4, steps 14-17; and col.8, lines 32-45)

*computing a preconditioner for the coefficient matrix A that is compatible
with the linear system of equations and that provides at least basis
function support over at least two mesh elements, where coupling of the
preconditioner between partitions is only through basis functions at the
partition boundaries.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and
col.7, lines 10-57)

16. In regards to Claim 2, Ushiro teaches the following limitations:

*2. A method as in claim 1, where the preconditioner is itself a valid
solution to the same set of physical equations that govern the full linear
system.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and
col.7, lines 10-57)

17. In regards to Claim 3, Ushiro teaches the following limitations:

*3. A method as in claim 1, where computing a preconditioner operates to
compute a preconditioning matrix K where partition boundaries are
constrained to coincide with the edges of mesh elements, and to compute
mesh element interactions using reduced coupling.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and
col.7, lines 10-57)

18. In regards to Claim 4, Ushiro teaches the following limitations:

*4. A method as in claim 3, where mesh element interactions between
basis functions are computed only for half functions within the same
partition, where a half function denotes the function over any one of*

multiple mesh elements for which it is defined, and where the interactions of basis functions crossing a partition boundary are computed separately for each of the half functions such that no interactions exist between basis function halves that are defined in separate ones of the partitions, and those basis functions completely within a partition, referred to as interior elements, interact only with other interior elements and with boundary element halves within the same partition.

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

19. In regards to Claim 5, Ushiro teaches the following limitations:

5. A method as in claim 4, further comprising sorting indices of basis functions in the matrices A and K so that all internal elements appear first, grouped according to their respective partitions, followed by all boundary elements, and where a resulting preconditioning matrix K for n partitions has the form:

$$K = \begin{bmatrix} [Ka_1] & & & \\ & [Ka_2] & & \\ & & & [Kb] \\ & & & \\ & & [Ka_n] & \\ & [Kc] & & [Kd] \end{bmatrix}$$

where the sub matrix Ka is the block diagonal matrix created by the union of the matrices of internal element interactions Kai through Ka,,, Kd represents the interactions between the boundary elements, and Kb and Kc are the interactions between the internal and boundary elements.

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

20. In regards to Claim 6, Ushiro teaches the following limitations:

6. A method as in claim 5, further comprising iteratively solving a system of equations Ax=f using the linear system matrix A, a vector f of boundary conditions on each mesh element and the preconditioner matrix K to provide an approximate solution x.

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

21. In regards to Claim 7, Ushiro teaches the following limitations:

> *7. A method as in claim 6, where the linear system matrix A is partitioned in the same manner as the preconditioner using the same partitions, separate partitions, or a combination of the same and separate partitions.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

22. In regards to Claim 8, Ushiro teaches the following limitations:

> *8. A method as in claim 6, where iteratively solving comprises operating a conjugate gradient iterative solver.*

(See Ushiro, especially: Fig.4, step 16; and col.8, lines 32-45; and Fig.1, and col.7, lines 10-57)

23. **Claims 9-16 and 17-24 are rejected based on the same reasoning as claims 1-8. Claims 9-16 are signal bearing media claims, and claims 17-24 are digital processing system claims that recite limitations equivalent to those recited in method claims 1-8 and taught throughout Ushiro.**

Conclusion

24. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.

25. Botta, E.F.F. et al. "How Fast the Laplace Equation Was Solved in 1995." Applied Numerical Mathematics, 1997. Vol.24, pp.439-455. (See especially section 3.4, "ICCG with Diagonal and Hyperplane Ordering." The ICCG method is cited in Ushiro, col.1, lines 25-40).

26. Gustafsson, I. "A Class of First Order Factorization Methods." <u>BIT Numerical Mathematics</u>, June 1978. Vol.18, Number 2, pp.142-156. (This reference is cited in Ushiro, col.1, lines 25-40).

27. Paolini, G.V. and Di Brozolo, G.R. "Data Structures to Vectorize CG Algorithms for General Sparsity Patterns." Dec. 1989. Vol.29, No. 4, pp.703-718. (The conjugate gradient [CG] method is cited in Ushiro, col.1, lines 25-40).

28. Barrett, R. et al. <u>Templates for the Solution of Linear Systems: Building Blocks for Iterative Methods</u>. 1993. Chapter 3 – pp.35-49. (Teaches various types of preconditioners).

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753.

Any response to this office action should be faxed to (571) 273-8300, or mailed to:
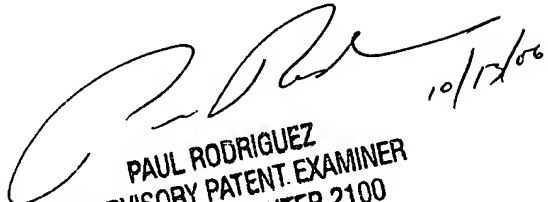
USPTO
P.O. Box 1450
Alexandria, VA 22313-1450

or hand carried to:

USPTO
Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Any inquiry of a general nature or relating to the status of this application

or proceeding should be directed to the Tech Center 2100 Receptionist, whose

telephone number is (571) 272-2100.

Ayal I. Sharon
Art Unit 2123
October 13, 2006

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